



## IMPROVED REFRACTORY MATERIALS FOR SLAGGING GASIFICATION SYSTEMS

Advances in technology are often directly linked to materials development. For gasification, the reliability and affordability of gasifier operation depends directly on the service life and performance of the refractory materials used to contain the high-temperature gasification reaction.

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In the most severe areas of a slagging gasifier, where tons of molten slag each day flow by at temperatures in excess of 1350 °C, refractory service life may be no more than 90 days, requiring complete shut down of the gasifier island every three months for material replacement. Unless there is a second gasifier available, these shutdowns result in no syngas production, and therefore no product for 7 to 14 days. The costs of these shutdowns, including lost opportunity costs, can reach into the millions. To help address this issue, scientists at the National Energy Technology Laboratory (NETL) have developed and patented a new refractory designed specifically for longer service life in this application. Field tests of this new refractory are currently underway at several commercial gasifier sites in the United States. Simultaneously, development work continues at NETL to design new materials and systems that can match or beat current refractory performance at a lower cost and with less environmental impact. The target is a refractory material that can last years, rather than months, providing the gasifier operator with the opportunity to achieve the 90 percent + on-line availability industrial goal.



Rotary slag test.



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In addition to the improved refractory, an NETL-designed thermocouple assembly also has been developed with the goal of providing longer and more consistent temperature measurement to the gasifier operator, leading to better operational control of the system. Current generation thermocouples are very susceptible to the harsh operating environment inside the slagging gasifier and often fail within hours of gasifier start-up, leaving the operator with no real-time means of temperature measurement. NETL's design for this thermocouple focuses on an enhanced ceramic protection system that can better shield the thermocouple from the corrosive components of the molten slag with improved fabrication and installation methodologies. Field tests in a commercial coal-fed gasifier will continue this year to prove the concept.



Conventional refractory after rotary slag testing.



Phosphate modified high-chrome oxide refractory material developed after rotary slag testing.



Test thermocouples being installed in a commercial gasifier.

Improvement in materials service life translates directly to improved gasifier reliability and reduced operational costs, both of which are necessary to make gasification a viable means of generating energy from fossil fuel sources.

The refractory materials currently being field-tested were produced in collaboration with Harbison-Walker Refractories

Company, a major refractories supplier for the industry. Field tests to date have been run at the Eastman Chemical Company's Kingsport, TN, site, with additional tests planned at Eastman, at Tampa Electric Company's Polk Power Station in Lakeland, FL, and at the Wabash River Power Station in Terre Haute, IN. Funding for this project comes via NETL's Advanced Metallurgical Processes line, as well as Department of Energy, Fossil Energy's Advanced Gasification Technologies and Advanced Research- Materials technology lines.



A test panel of phosphate-containing, high-chrome oxide refractory (brick marked in red) installed in a commercial slagging gasifier.